

Trends and anomalies in Nova large scale length plasma experiments*

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Since 1993 there has been an increased emphasis on plasma physics in experiments at the Nova laser at Lawrence Livermore National Laboratory. The motivation for these experiments was the concern that scattering of laser light by parametric instabilities would present a severe challenge to achieving symmetry and good energy coupling into hohlraums on the National Ignition Facility (NIF). The experiments necessitated developing large scale length plasmas of high temperature in order to simulate different aspects of the NIF ignition hohlraum design. Diagnostics for back, side and forward scatter were developed across a broad energy band. One goal of the experiments was to study the effects of beam smoothing on the scattering instabilities, with NIF relevant beam geometry. The series of experiments resulted in increased confidence that with the right beam smoothing and control of plasma conditions, scattered light will be at tolerable levels and should not prevent achieving ignition on NIF. In the course of the experiments, many interesting discoveries were made; these include: the sensitivity of SBS to ion damping in homogeneous plasmas, the reemergence of SRS as a significant energy loss mechanism with SRS backscatter tightly collimated back into the incident beam solid angle, beam deflection in flowing plasmas, large angular spread and deflection of backscattered SBS, the sensitivity of SRS to ion wave damping suggesting that secondary decay processes limit SRS, the ability to transfer energy from one beam to another by scattering off ion waves, self smoothing and generation of bandwidth on the transmitted beam, and the sensitivity of short wavelength SRS to beam smoothing. These results have stimulated fertile growth of our theoretical understanding of plasma instabilities. There are still many anomalies that we are attempting to explain. These include the anomalously low SBS gain measured in crossed beam experiments and the startling anti-correlation of SBS with density in our homogeneous plasmas. This paper will review some of the trends that have been observed in gasbag experiments and focus on some of the anomalies that remain.

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Prefer oral session

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